Software Engineering

Cloud Computing and
Cloud Software Architecture

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Associate Professor

Institute of Information Management, National Taipei University

https://web.ntpu.edu.tw/~myday
<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Subject/Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2022/02/23</td>
<td>Introduction to Software Engineering</td>
</tr>
<tr>
<td>2</td>
<td>2022/03/02</td>
<td>Software Products and Project Management: Software product management and prototyping</td>
</tr>
<tr>
<td>3</td>
<td>2022/03/09</td>
<td>Agile Software Engineering: Agile methods, Scrum, and Extreme Programming</td>
</tr>
<tr>
<td>4</td>
<td>2022/03/16</td>
<td>Features, Scenarios, and Stories</td>
</tr>
<tr>
<td>5</td>
<td>2022/03/23</td>
<td>Case Study on Software Engineering I</td>
</tr>
<tr>
<td>6</td>
<td>2022/03/30</td>
<td>Software Architecture: Architectural design, System decomposition, and Distribution architecture</td>
</tr>
</tbody>
</table>
# Syllabus

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Subject/Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>2022/04/06</td>
<td>Make-up holiday (No Classes)</td>
</tr>
<tr>
<td>8</td>
<td>2022/04/13</td>
<td>Midterm Project Report</td>
</tr>
<tr>
<td>9</td>
<td>2022/04/20</td>
<td>Cloud-Based Software: Virtualization and containers, Everything as a service, Software as a service</td>
</tr>
<tr>
<td>10</td>
<td>2022/04/27</td>
<td>Cloud Computing and Cloud Software Architecture</td>
</tr>
<tr>
<td>11</td>
<td>2022/05/04</td>
<td>Microservices Architecture, RESTful services, Service deployment</td>
</tr>
</tbody>
</table>
## Syllabus

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Subject/Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>2022/05/18</td>
<td>Case Study on Software Engineering II</td>
</tr>
<tr>
<td>14</td>
<td>2022/05/25</td>
<td>Security and Privacy; Reliable Programming; Testing: Test-driven development, and Code reviews; DevOps and Code Management: DevOps automation</td>
</tr>
<tr>
<td>15</td>
<td>2022/06/01</td>
<td>Final Project Report I</td>
</tr>
<tr>
<td>16</td>
<td>2022/06/08</td>
<td>Final Project Report II</td>
</tr>
<tr>
<td>17</td>
<td>2022/06/15</td>
<td>Self-learning</td>
</tr>
<tr>
<td>18</td>
<td>2022/06/22</td>
<td>Self-learning</td>
</tr>
</tbody>
</table>
Cloud Computing and Cloud Software Architecture
Software Engineering
and
Project Management

Analyze
Requirements
definition

Design
System and
Software
design

Build
Implementation
and
unit testing

Test
Integration
and
system testing

Deliver
Operation
and
maintenance

Project Management
Information Management (MIS)
Information Systems

Fundamental MIS Concepts

Project-based software engineering

CUSTOMER generates

Problem

helps-with

Software

implemented-by

DEVELOPER

CUSTOMER and DEVELOPER

Software execution models

**Stand-alone execution**

- User’s computer
- User interface
- Product functionality
- User data
- Product updates
- Vendor’s servers

**Hybrid execution**

- User’s computer
- User interface
- Partial functionality
- User data
- Additional functionality
- User data backups
- Product updates
- Vendor’s servers

**Software as a service**

- User’s computer
- User interface
  - (browser or app)
- Product functionality
- User data
- Product functionality
- User data backups
- Product updates
- Vendor’s servers

Product management concerns

Product manager

Business needs

Technology constraints

Customer experience

Technical interactions of product managers

Software Development Life Cycle (SDLC)

The waterfall model

- Requirements definition
- System and Software design
- Implementation and unit testing
- Integration and system testing
- Operation and maintenance

Plan-based and Agile development

Plan-based development

- Requirements engineering
- Requirements specification
- Design and implementation

Requirements change requests

Agile development

- Requirements engineering
- Design and implementation

The Continuum of Life Cycles

- **Iterative**: High frequency of delivery, high degree of change.
- **Predictive**: Low frequency of delivery, low degree of change.
- **Incremental**: Low frequency of delivery, high degree of change.
- **Agile**: High frequency of delivery, high degree of change.

Predictive Life Cycle

Iterative Life Cycle

Analyze → Analyze Design → Build Test → Deliver

Prototype → Refine

A Life Cycle of Varying-Sized Increments

Iteration-Based and Flow-Based Agile Life Cycles

**Iteration-Based Agile**

1. Requirements Analysis
2. Design
3. Build
4. Test

Repeat as needed...

**Flow-Based Agile**

1. Requirements Analysis
2. Design
3. Build
4. Test

the number of features in the WIP limit

Repeat as needed...

From personas to features

1. **Personas**
   - A way of representing users
   - Natural language descriptions of a user interacting with a software product

2. **Scenarios**
   - Natural language descriptions of something that is needed or wanted by users

3. **Stories**
   - Fragments of product functionality

4. **Features**

Multi-tier client-server architecture

Service-oriented Architecture

VM

Virtual web server

Virtual mail server

Server software

Guest OS

Hypervisor

Host OS

Server Hardware

Container

User 1

Container 1

User 2

Container 2

Application software

Server software

Application software

Server software

Container manager

Host OS

Server Hardware

Everything as a service

- **Infrastructure as a service (IaaS)**
  - Cloud data center

- **Platform as a service (PaaS)**
  - Photo editing
  - Cloud management
  - Monitoring
  - Storage
  - Network

- **Software as a service (SaaS)**
  - Logistics management
  - Database software development
  - Computing virtualization

Software as a service

Software provider

Cloud provider

Software customers

Software services

Cloud Infrastructure

Microservices architecture – key design questions

- What are the microservices that make up the system?
- How should microservices communicate with each other?
- How should data be distributed and shared?
- How should the microservices in the system be coordinated?
- How should service failure be detected, reported and managed?

Types of security threat

**Availability threats**
- An attacker attempts to deny access to the system for legitimate users
- Distributed denial of service (DDoS) attack

**Integrity threats**
- An attacker attempts to damage the system or its data

**Confidentiality threats**
- An attacker tries to gain access to private information held by the system

**SOFTWARE PRODUCT**
- PROGRAM
- DATA

**Examples of threats**
- Virus
- Ransomware
- Data theft

Software product quality attributes

1. Reliability
2. Availability
3. Resilience
4. Maintainability
5. Responsiveness
6. Usability
7. Security

A refactoring process

1. Identify code ‘smell’
2. Identify refactoring strategy
3. Make small improvement until strategy completed
4. Run automated code tests

Functional testing

1. Unit Testing
2. Feature Testing
3. System Testing
4. Release Testing

Test-driven development (TDD)

1. Identify new functionality
2. Identify partial implementation of functionality
3. Write code stub that will fail test
4. Run all automated test
5. Implement code that should cause failing test to pass
6. Run all automated test
7. Refactor code if required

Functionality complete
Functionality incomplete
All tests pass

DevOps

Development

Deployment

Support

Multi-skilled DevOps team

Code management and DevOps

DevOps automation
- Continuous integration
- Continuous deployment
- Continuous delivery
- Infrastructure as code

Code management system
- Branching and merging
  - Recover version information
  - Save and retrieve versions
  - Transfer code to/from developer’s filestore

DevOps measurement
- Data collection
- Data analysis
- Report generation

Cloud Computing and Cloud Software Architecture
Outline

• Cloud Computing and Cloud Software Architecture
• AWS Certified Cloud Practitioner (CLF-C01)
• AWS Certified Solutions Architect – Associate (SAA-C02)
• Web Application with AWS Core Services
• AWS Serverless Architecture
• Build a Serverless Web Application with Amazon S3, AWS Lambda, Amazon API Gateway, Amazon DynamoDB, and Amazon Cognito
AWS Certifications

Accredited Educator

Cloud Practitioner

Solutions Architect
Associate
AWS Products and Services

Analytics

Business Applications

End User Computing

Media Services

Robotics

Application Integration

Compute

Game Tech

Migration & Transfer

Satellite

AR & VR

Customer Engagement

Internet of Things

Mobile

Security, Identity & Compliance

AWS Cost Management

Database

Machine Learning

Networking & Content Delivery

Storage

Blockchain

Developer Tools

Management & Governance

Quantum Technologies

Source: https://aws.amazon.com/
## AWS Compute

<table>
<thead>
<tr>
<th>Service</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amazon EC2</strong></td>
<td>Virtual servers in the cloud</td>
</tr>
<tr>
<td><strong>Amazon Elastic Container Service</strong></td>
<td>Run and manage docker containers</td>
</tr>
<tr>
<td><strong>AWS Batch</strong></td>
<td>Run batch jobs at any scale</td>
</tr>
<tr>
<td><strong>AWS Lambda</strong></td>
<td>Run code without thinking about servers</td>
</tr>
<tr>
<td><strong>AWS Wavelength</strong></td>
<td>Deliver ultra-low latency applications for 5G devices</td>
</tr>
<tr>
<td><strong>Amazon EC2 Auto Scaling</strong></td>
<td>Scale compute capacity to meet demand</td>
</tr>
<tr>
<td><strong>Amazon Elastic Kubernetes Service</strong></td>
<td>Run managed Kubernetes on AWS</td>
</tr>
<tr>
<td><strong>AWS Elastic Beanstalk</strong></td>
<td>Run and manage web apps</td>
</tr>
<tr>
<td><strong>AWS Outposts</strong></td>
<td>Run AWS infrastructure on-premises</td>
</tr>
<tr>
<td><strong>VMware Cloud on AWS</strong></td>
<td>Build a hybrid cloud without custom hardware</td>
</tr>
<tr>
<td><strong>Amazon Elastic Container Registry</strong></td>
<td>Store and retrieve docker images</td>
</tr>
<tr>
<td><strong>Amazon Lightsail</strong></td>
<td>Launch and manage virtual private servers</td>
</tr>
<tr>
<td><strong>AWS Fargate</strong></td>
<td>Run containers without managing servers or clusters</td>
</tr>
<tr>
<td><strong>AWS Serverless Application Repository</strong></td>
<td>Discover, deploy, and publish serverless applications</td>
</tr>
</tbody>
</table>

Source: [https://aws.amazon.com/](https://aws.amazon.com/)
AWS Database

Amazon Aurora
High Performance Managed Relational Database

Amazon ElastiCache
In-memory Caching System

Amazon Quantum Ledger Database (QLDB)
Fully managed ledger database

Amazon Redshift
Fast, Simple, Cost-effective Data Warehousing

Amazon DynamoDB
Managed NoSQL Database

Amazon Managed Apache Cassandra Service
Managed Cassandra-compatible database

Amazon RDS
Managed Relational Database Service for MySQL, PostgreSQL, Oracle, SQL Server, and MariaDB

Amazon DocumentDB (with MongoDB compatibility)
Fully managed document database

Amazon Neptune
Fully Managed Graph Database Service

Amazon RDS on VMware
Automate on-premises database management

Amazon Timestream
Fully managed time series database

AWS Database Migration Service
Migrate Databases with Minimal Downtime

Source: https://aws.amazon.com/
AWS Storage

Amazon Simple Storage Service (S3)
Scalable Storage in the Cloud

Amazon Elastic Block Store (EBS)
EC2 block storage volumes

Amazon Elastic File System (EFS)
Fully managed file system for EC2

Amazon FSx for Lustre
High-performance file system integrated with S3

Amazon FSx for Windows File Server
Fully managed Windows native file system

Amazon S3 Glacier
Low-cost Archive Storage in the Cloud

AWS Backup
Centralized backup across AWS services

AWS Snow Family
Physical devices to migrate data into and out of AWS

CloudEndure Disaster Recovery
Highly automated disaster recovery

Source: https://aws.amazon.com/
AWS Networking & Content Delivery

- **Amazon VPC**
  Isolated Cloud Resources

- **Amazon Route 53**
  Scalable Domain Name System

- **AWS Cloud Map**
  Application resource registry for microservices

- **AWS Transit Gateway**
  Easily scale VPC and account connections

- **Amazon API Gateway**
  Build, Deploy, and Manage APIs

- **AWS PrivateLink**
  Securely Access Services Hosted on AWS

- **AWS Direct Connect**
  Dedicated Network Connection to AWS

- **Elastic Load Balancing**
  Distribute incoming traffic across multiple targets

- **Amazon CloudFront**
  Global Content Delivery Network

- **AWS App Mesh**
  Monitor and control microservices

- **AWS Global Accelerator**
  Improve application availability and performance

Source: [https://aws.amazon.com/](https://aws.amazon.com/)
# AWS Security, Identity & Compliance

<table>
<thead>
<tr>
<th>Service</th>
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</tr>
</thead>
<tbody>
<tr>
<td>AWS Identity &amp; Access Management</td>
<td>Manage User Access and Encryption Keys</td>
</tr>
<tr>
<td>Amazon GuardDuty</td>
<td>Managed Threat Detection Service</td>
</tr>
<tr>
<td>AWS Artifact</td>
<td>On-demand access to AWS compliance reports</td>
</tr>
<tr>
<td>AWS Directory Service</td>
<td>Host and Manage Active Directory</td>
</tr>
<tr>
<td>AWS Resource Access Manager</td>
<td>Simple, secure service to share AWS resources</td>
</tr>
<tr>
<td>AWS Shield</td>
<td>DDoS Protection</td>
</tr>
<tr>
<td>Amazon Cognito</td>
<td>Identity Management for your Apps</td>
</tr>
<tr>
<td>Amazon Inspector</td>
<td>Analyze Application Security</td>
</tr>
<tr>
<td>AWS Certificate Manager</td>
<td>Provision, Manage, and Deploy SSL/TLS Certificates</td>
</tr>
<tr>
<td>AWS Firewall Manager</td>
<td>Central Management of Firewall Rules</td>
</tr>
<tr>
<td>AWS Secrets Manager</td>
<td>Rotate, Manage, and Retrieve Secrets</td>
</tr>
<tr>
<td>AWS Single Sign-On</td>
<td>Cloud Single Sign-On (SSO) Service</td>
</tr>
<tr>
<td>Amazon Detective</td>
<td>Investigate potential security issues</td>
</tr>
<tr>
<td>Amazon Macie</td>
<td>Discover, Classify, and Protect your Data</td>
</tr>
<tr>
<td>AWS CloudHSM</td>
<td>Hardware-based Key Storage for Regulatory Compliance</td>
</tr>
<tr>
<td>AWS Key Management Service</td>
<td>Managed Creation and Control of Encryption Keys</td>
</tr>
<tr>
<td>AWS Security Hub</td>
<td>Unified security and compliance center</td>
</tr>
<tr>
<td>AWS WAF</td>
<td>Filter Malicious Web Traffic</td>
</tr>
</tbody>
</table>

Source: [https://aws.amazon.com/](https://aws.amazon.com/)
AWS Cost Management

**AWS Cost Explorer**
Analyze Your AWS Cost and Usage

**AWS Budgets**
Set Custom Cost and Usage Budgets

**AWS Cost and Usage Report**
Access Comprehensive Cost and Usage Information

**Reserved Instance Reporting**
Dive Deeper into Your Reserved Instances (RIs)

**Savings Plans**
Save up to 72% on compute usage with flexible pricing

Source: [https://aws.amazon.com/](https://aws.amazon.com/)
AWS Services

• Amazon EC2
  • Virtual servers in the cloud

• Amazon Simple Storage Service (S3)
  • Scalable storage in the cloud

• Amazon Aurora
  • High performance managed relational database

• Amazon DynamoDB
  • Managed NoSQL database

• Amazon RDS
  • Managed relational database service for MySQL, PostgreSQL, Oracle, SQL Server, and MariaDB

Source: https://aws.amazon.com/
AWS Services

• AWS Lambda
  • Run code without thinking about servers

• AWS Elastic Beanstalk
  • Run and manage web apps

• Amazon VPC
  • Isolated cloud resources

• Amazon Lightsail
  • Launch and manage virtual private servers

• Amazon SageMaker
  • Build, train, and deploy machine learning models at scale

Source: https://aws.amazon.com/
Available AWS Certifications

Professional

Two years of comprehensive experience designing, operating, and troubleshooting solutions using the AWS Cloud

SAP

Associate

One year of experience solving problems and implementing solutions using the AWS Cloud

SAA

Foundational

Six months of fundamental AWS Cloud and industry knowledge

CLF

Specialty

Technical AWS Cloud experience in the Specialty domain as specified in the exam guide

- Advanced Networking
- Data Analytics
- Database
- Machine Learning
- Security

https://aws.amazon.com/certification/
AWS Certification

Validate technical skills and cloud expertise to grow your career and business.

Get started

Certification exam guides and details
Explore our role-based certifications and our Specialty certifications in specific technical areas. Select an exam to learn more:

Options for taking your exam
Curious about how to take your AWS Certification exam? We offer flexible, convenient options for taking exams so you can select what works best for you.

Access your AWS Certification Account
Schedule and take exams from your AWS Certification Account. You can also access your AWS Certified benefits, such as your digital badge and 50% discount voucher for a future exam.

https://aws.amazon.com/certification/
AWS Certification

Format
65 questions; either multiple choice or multiple response

Type
Foundational

Delivery Method
Testing center or online proctored exam

Time
90 minutes to complete the exam

Cost
100 USD (Practice Exam: 20 USD)

Language
Available in English, Indonesian (Bahasa), Japanese, Korean, and Simplified Chinese

https://aws.amazon.com/certification/
AWS Certification

**Format**
65 questions; either multiple choice or multiple response

**Type**
Associate

**Delivery Method**
Testing center or online proctored exam

**Time**
130 minutes to complete the exam

**Cost**
150 USD (Practice exam: 20 USD)

**Language**
Available in English, Japanese, Korean, and Simplified Chinese

https://aws.amazon.com/certification/
AWS Certification

Professional
Two years of comprehensive experience designing, operating, and troubleshooting solutions using the AWS Cloud

Format
75 questions; either multiple choice or multiple response

Type
Professional

Delivery Method
Testing center or online proctored exam

Time
180 minutes to complete the exam

Cost
300 USD (Practice Exam: 40 USD)

Language
Available in English, Japanese, Korean, and Simplified Chinese

https://aws.amazon.com/certification/
AWS Certification

Format
65 questions; either multiple choice or multiple response

Type
Associate

Delivery Method
Testing center or online proctored exam

Time
130 minutes to complete the exam

Cost
150 USD (Practice exam: 20 USD)

Language
Available in English, Japanese, Korean, and Simplified Chinese

https://aws.amazon.com/certification/
AWS Certification

Associate

One year of experience solving problems and implementing solutions using the AWS Cloud

Formal
- 65 questions; either multiple choice or multiple response

Type
- Associate

Delivery Method
- Testing center or online proctored exam

Time
- 130 mins to complete the exam

Cost
- 150 USD (Practice exam: 20 USD)

Language
- Available in English, Japanese, Korean, and Simplified Chinese

https://aws.amazon.com/certification/
AWS Certification

Professional

Two years of comprehensive experience designing, operating, and troubleshooting solutions using the AWS Cloud

Format
75 questions; either multiple choice or multiple response

Type
Professional

Delivery Method
Testing center or online proctored exam

Time
180 minutes to complete the exam

Cost
300 USD (Practice exam: 40 USD)

Language
Available in English, Japanese, Korean, and Simplified Chinese

https://aws.amazon.com/certification/
AWS Certification

Specialty

Technical AWS Cloud experience in the Specialty domain as specified in the exam guide

Format
65 questions; either multiple choice or multiple response

Type
Specialty

Delivery Method
Testing center or online proctored exam

Time
180 minutes to complete the exam

Cost
300 USD (Practice exam: 40 USD)

Language
Available in English, Japanese, Korean, and Simplified Chinese

https://aws.amazon.com/certification/
AWS Certifications Roadmap

[Diagram with AWS certification badges and titles:
- Certified Cloud Practitioner
- Certified Solutions Architect Associate
- Certified Developer Associate
- Certified SysOps Administrator Associate
- Certified DevOps Engineer Professional
- Certified Solutions Architect Professional
- Certified Security Specialty
- Certified Advanced Networking Specialty
- Certified Database Specialty
- Certified Data Analytics Specialty
- Certified Machine Learning Specialty

https://aws.amazon.com/certification/
AWS Certifications Roadmap

Cloud Architect

https://aws.amazon.com/certification/
AWS Certifications Roadmap

Cloud Developer

https://aws.amazon.com/certification/
AWS Certifications Roadmap

DevOps

https://aws.amazon.com/certification/
AWS Certifications Roadmap

Data Analytics / Machine Learning

https://aws.amazon.com/certification/
AWS Certifications Roadmap

Security

https://aws.amazon.com/certification/
AWS Certified Cloud Practitioner (CLF-C01)

Source: https://aws.amazon.com/certification/certified-cloud-practitioner/
AWS Certified Cloud Practitioner

• This certification provides individuals in a larger variety of cloud and technology roles with a way to validate their AWS Cloud knowledge and enhance their professional credibility.

• This exam covers four domains, including cloud concepts, security, technology, and billing and pricing.

https://aws.amazon.com/certification/certified-cloud-practitioner/
AWS Certified Solutions Architect – Associate (SAA-C02)

Source: https://aws.amazon.com/certification/certified-solutions-architect-associate
AWS Certified Solutions Architect – Associate

• This certification validates your ability to effectively demonstrate knowledge of how to architect and deploy secure and robust applications on AWS technologies.

• This exam is for anyone with at least one year of hands-on experience designing available, cost-efficient, fault-tolerant, and scalable and distributed systems on AWS.

AWS Academy and Certifications

• AWS Academy **Cloud Foundations** (ACF)
  • AWS Certified **Cloud Practitioner** (CLF-C01)

• AWS Academy **Cloud Architecting** (ACA)
  • AWS Certified **Solutions Architect – Associate** (SAA-C02)
# AWS Certified Cloud Practitioner (CLF-C01)

<table>
<thead>
<tr>
<th>Domain</th>
<th>% of Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domain 1: Cloud Concepts</td>
<td>26%</td>
</tr>
<tr>
<td>Domain 2: Security and Compliance</td>
<td>25%</td>
</tr>
<tr>
<td>Domain 3: Technology</td>
<td>33%</td>
</tr>
<tr>
<td>Domain 4: Billing and Pricing</td>
<td>16%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

# AWS Certified Solutions Architect – Associate (SAA-C02)

<table>
<thead>
<tr>
<th>Domain</th>
<th>% of Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domain 1: Design Resilient Architectures</td>
<td>30%</td>
</tr>
<tr>
<td>Domain 2: Design High-Performing Architectures</td>
<td>28%</td>
</tr>
<tr>
<td>Domain 3: Specify Secure Applications and Architectures</td>
<td>24%</td>
</tr>
<tr>
<td>Domain 4: Design Cost-Optimized Architectures</td>
<td>18%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100%</td>
</tr>
</tbody>
</table>

AWS Certified Cloud Practitioner (CLF-C01)

Source: https://aws.amazon.com/certification/certified-cloud-practitioner/
AWS Certified Cloud Practitioner (CLF-C01)

- Domain 1: Cloud Concepts
  - 1.1 Define the AWS Cloud and its value proposition
  - 1.2 Identify aspects of AWS Cloud economics
  - 1.3 List the different cloud architecture design principles

Source: https://aws.amazon.com/certification/certified-cloud-practitioner/
AWS Certified Cloud Practitioner (CLF-C01)

• Domain 2: Security and Compliance
  • 2.1 Define the AWS shared responsibility model
  • 2.2 Define AWS Cloud security and compliance concepts
  • 2.3 Identify AWS access management capabilities
  • 2.4 Identify resources for security support

Source: https://aws.amazon.com/certification/certified-cloud-practitioner/
AWS Certified Cloud Practitioner (CLF-C01)

• Domain 3: Technology
  
  • 3.1 Define methods of deploying and operating in the AWS Cloud
  
  • 3.2 Define the AWS global infrastructure
  
  • 3.3 Identify the core AWS services
  
  • 3.4 Identify resources for technology support

Source: https://aws.amazon.com/certification/certified-cloud-practitioner/
AWS Certified Cloud Practitioner (CLF-C01)

• Domain 4: Billing and Pricing
  • 4.1 Compare and contrast the various pricing models for AWS
  • 4.2 Recognize the various account structures in relation to AWS billing and pricing
  • 4.3 Identify resources available for billing support

Source: https://aws.amazon.com/certification/certified-cloud-practitioner/
AWS Certified Solutions Architect – Associate (SAA-C02)

Source: https://aws.amazon.com/certification/certified-solutions-architect-associate
Domain 1: Design Resilient Architectures

1.1 Design a multi-tier architecture solution
1.2 Design highly available and/or fault-tolerant architectures
1.3 Design decoupling mechanisms using AWS services
1.4 Choose appropriate resilient storage
• Domain 2: Design **High-Performing Architectures**
  • 2.1 Identify elastic and scalable compute solutions for a workload
  • 2.2 Select high-performing and scalable storage solutions for a workload
  • 2.3 Select high-performing networking solutions for a workload
  • 2.4 Choose high-performing database solutions for a workload

AWS Certified Solutions Architect – Associate (SAA-C02)

• Domain 3: Design Secure Applications and Architectures
  • 3.1 Design secure access to AWS resources
  • 3.2 Design secure application tiers
  • 3.3 Select appropriate data security options

Source: https://aws.amazon.com/certification/certified-solutions-architect-associate
• Domain 4: Design **Cost-Optimized** Architectures
  
  • 4.1 Identify cost-effective storage solutions
  • 4.2 Identify cost-effective compute and database services
  • 4.3 Design cost-optimized network architectures

# AWS Certifications Exam Pricing

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<thead>
<tr>
<th>Exam Type</th>
<th>Price in USD</th>
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<tbody>
<tr>
<td>Foundational</td>
<td>$100</td>
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<tr>
<td>Associate</td>
<td>$150</td>
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<tr>
<td>Professional</td>
<td>$300</td>
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<td>Specialty</td>
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AWS Certified Security – Specialty validates expertise in securing data and workloads in the AWS Cloud
AWS Certified Security – Specialty is intended for individuals who perform a security role and have at least two years of hands-on experience securing AWS workloads.

- Five years of IT security experience in designing and implementing security solutions and at least two years of hands-on experience in securing AWS workloads
- Working knowledge of AWS security services and features of services to provide a secure production environment and an understanding of security operations and risks
- Knowledge of the AWS shared responsibility model and its application; security controls for workloads on AWS; logging and monitoring strategies; cloud security threat models; patch management and security automation; ways to enhance AWS security services with third-party tools and services; and disaster recovery controls, including BCP and backups, encryption, access control, and data retention
- Understanding of specialized data classifications and AWS data protection mechanisms, data-encryption methods and AWS mechanisms to implement them, and secure internet protocols and AWS mechanisms to implement them
- Ability to make tradeoff decisions with regard to cost, security, and deployment complexity to meet a set of application requirements

https://aws.amazon.com/certification/certified-security-specialty
AWS Certified Cloud Practitioner

• This certification provides individuals in a larger variety of cloud and technology roles with a way to validate their AWS Cloud knowledge and enhance their professional credibility.

• This exam covers four domains, including cloud concepts, security, technology, and billing and pricing.

https://aws.amazon.com/certification/certified-cloud-practitioner/
AWS Certified Solutions Architect – Associate

• This certification validates your ability to effectively demonstrate knowledge of how to architect and deploy secure and robust applications on AWS technologies.

• This exam is for anyone with at least one year of hands-on experience designing available, cost-efficient, fault-tolerant, and scalable and distributed systems on AWS.

Web Application with AWS Core Services
fb.com on AWS

AWS Application Services

AWS Security Services

AWS Development and DevOps Services

AWS
Serverless
Architecture
AWS Serverless Airline Booking

Source: https://github.com/aws-samples/aws-serverless-airline-booking
AWS Serverless Airline Booking Stack

UI/UX
- Quasar framework
- Vue.js
- AWS Amplify
- Stripe Elements

Data/Lang
- Amazon DynamoDB
- Python
- TypeScript
- JavaScript

API/Auth
- AWS AppSync
- Amazon API Gateway
- Amazon Cognito

Messaging
- Amazon SNS
- AWS Step Functions

Source: https://github.com/aws-samples/aws-serverless-airline-booking
AWS Serverless Airline Booking
High level infrastructure architecture

Source: https://github.com/aws-samples/aws-serverless-airline-booking
AWS Serverless Architecture

AWS Operational Responsibility Models

Source: Heitor Lessa (2019), How to build a full stack serverless airline ticketing web app, https://www.youtube.com/watch?v=MyoOeHTa2ag
Build
a
Serverless
Web Application
Build a Serverless Web Application

Overview

In this tutorial, you'll create a simple serverless web application that enables users to request unicorn rides from the Wild Rydes fleet. The application will present users with an HTML based user interface for indicating the location where they would like to be picked up and will interface on the backend with a RESTful web service to submit the request and dispatch a nearby unicorn. The application will also provide facilities for users to register with the service and log in before requesting rides.

Application Architecture

AWS Experience: Beginner

Time to complete: 2 hours

Cost to complete: Each service used in this architecture is eligible for the AWS Free Tier. If you are outside the usage limits of the Free Tier, completing this tutorial will cost you less than $0.25*.

Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/
Build a Serverless Web Application with Amazon S3, AWS Lambda, Amazon API Gateway, Amazon DynamoDB, and Amazon Cognito

Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/
Build a Serverless Web Application with Amazon S3, AWS Lambda, Amazon API Gateway, Amazon DynamoDB, and Amazon Cognito

1. HTML, CSS, JavaScript, etc.
   - AMAZON S3

2. Authentication
   - AMAZON COGNITO USER POOL

3. Dynamic API calls over HTTP
   - AMAZON API GATEWAY
   - AWS LAMBDA
   - AMAZON DYNAMODB

Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/
Static Web Hosting

Amazon S3 hosts static web resources including HTML, CSS, JavaScript, and image files which are loaded in the user's browser.

Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/
Build a Serverless Web Application
with Amazon S3, AWS Lambda, Amazon API Gateway,
Amazon DynamoDB, and Amazon Cognito

HTML, CSS, JavaScript, etc.

Web Browser

Authentication

Dynamic API calls over HTTP

AMAZON S3

AMAZON API GATEWAY

AWS LAMBDA

AMAZON DYNAMODB

AMAZON COGNITO

USER POOL

Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/
User Management

Amazon Cognito provides user management and authentication functions to secure the backend API.
Build a Serverless Web Application with Amazon S3, AWS Lambda, Amazon API Gateway, Amazon DynamoDB, and Amazon Cognito

HTML, CSS, JavaScript, etc.

Web Browser

Authentication

Dynamic API calls over HTTP

AWS Lambda

Amazon S3

Amazon Cognito

Amazon DynamoDB

Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/
Build a Serverless Web Application with Amazon S3, AWS Lambda, Amazon API Gateway, Amazon DynamoDB, and Amazon Cognito

3

Serverless Backend

Amazon DynamoDB provides a persistence layer where data can be stored by the API's Lambda function.

Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/
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Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/
RESTful API

JavaScript executed in the browser sends and receives data from a public backend API built using Lambda and API Gateway.

Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/
Build a Serverless Web Application with Amazon S3, AWS Lambda, Amazon API Gateway, Amazon DynamoDB, and Amazon Cognito

5 Terminate resources

Resource Cleanup
You will terminate an Amazon S3 bucket, an Amazon Cognito User Pool, an AWS Lambda function, an IAM role, a DynamoDB table, a REST API, and a CloudWatch Log.
It is a best practice to delete resources you are no longer using to avoid unwanted charges.

Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/
Summary

• Cloud Computing and Cloud Software Architecture
• AWS Certified Cloud Practitioner (CLF-C01)
• AWS Certified Solutions Architect – Associate (SAA-C02)
• Web Application with AWS Core Services
• AWS Serverless Architecture
• Build a Serverless Web Application with Amazon S3, AWS Lambda, Amazon API Gateway, Amazon DynamoDB, and Amazon Cognito

References

• https://aws.amazon.com/certification/
• https://www.aws.training/
• https://aws.amazon.com/training/awsacademy/
• https://aws.amazon.com/education/awseducate/
• AWS Certified Cloud Practitioner
  • https://aws.amazon.com/certification/certified-cloud-practitioner/
• AWS Certified Solutions Architect – Associate
  • https://aws.amazon.com/certification/certified-solutions-architect-associate/
• AWS Cloud Practitioner Essentials (Second Edition)
  • https://aws.amazon.com/training/course-descriptions/cloud-practitioner-essentials/
• Architecting on AWS
  • https://aws.amazon.com/training/course-descriptions/architect/
References


• Titus Winters, Tom Manshreck, and Hyrum Wright (2020), Software Engineering at Google: Lessons Learned from Programming Over Time, O'Reilly Media.

